

Title: Playing in a Geo-World

Link to Outcomes:

- **Problem Solving** Students will demonstrate their ability to solve problems in mathematics including problems with open-ended answers and problems which are solved in a cooperative atmosphere.
- **Communication** Students will demonstrate their ability to communicate mathematically. They will read, write, and discuss mathematics with language and the signs, symbols, and terms of the discipline.
- **Reasoning** Students will demonstrate their ability to reason mathematically. They will make conjectures, gather evidence, and build arguments.
- **Connections** Students will demonstrate their ability to connect geometric concepts to architecture in the real world.
- **Estimation & Computation** Students will demonstrate their ability to apply estimation strategies in computation, with the use of technology in measurement, and in problem solving. They will determine reasonableness of solutions.
- **Technology** Students will demonstrate their ability to solve problems using arithmetic operations with technology, where appropriate.
- **Number Sense & Operations** Students will demonstrate their ability to describe and apply number relationships using concrete and abstract materials. They will choose operations and describe effects of operations on numbers.
- **Geometry & Spatial Sense** Students will demonstrate their ability to describe and apply geometric relationships using one, two, and three-dimensional objects. They will demonstrate congruency, similarity, symmetry, and reflection and apply these concepts to the solution of the geometric problems.
- **Measurement** Students will demonstrate and apply concepts of measurement using standard units and customary units. They will estimate and verify measurements. They will apply measurement to interdisciplinary and real-world problem-solving situations.
- **Patterns & Relationships** Students will demonstrate their ability to recognize numeric and geometric relationships and will generalize a relationship from data.
- **Mathematical Disposition** Students will demonstrate a positive attitude towards mathematics and will value and appreciate the role of mathematics in school, culture, and society.

Brief Overview:

This activity integrates geometric problem-solving with real-world architecture. Students will receive the task of designing and constructing a three-dimensional playground with given criteria. The students will also write to persuade. Students will apply their knowledge of geometry as they use a rubric to evaluate each group's model.

Grade/Level:

Grades 4-6

Duration/Length:

This activity should take 2 to 5 days.

Prerequisite Knowledge:

- Students should be able to identify and construct various types of angles and polygons.
- Students should be able to find the perimeter of a given shape.
- Students should be able to use customary units of measurement.
- Students should be familiar with scale drawings.

Objectives:

- Construct a rectangle with given dimensions.
- Determine appropriate scale.
- Design and construct equipment to meet criteria.
- Use a rubric to evaluate a model.
- Write a persuasive letter.

Materials/Resources/Printed Materials:**Materials for teacher**

- Models to show scale (model car, globe, blueprints, maps)
- Four yardsticks
- Copy of Resource Sheet #1
- Transparency of Resource Sheet #1

Materials per group of four

- Styrofoam - 12" by 36"
- Toothpicks
- Gumdrops/mini-marshmallows
- Pretzel sticks
- Coffee stirrers
- Pipe cleaners
- Clay
- Large paper
- Compass
- Craft sticks

*These are suggested materials. Cooperative groups may add or delete to meet their needs.

Materials per individual

- Scissors
- Glue
- Pencil
- Ruler
- Compass
- Protractor

Development/Procedures:

Day One

- Hand out and discuss Student Resource #1 “Geo-World Contest.”
- Divide the students into groups of four.
- Distribute rulers, two pieces of large paper (four pieces of one-inch grid paper, Student Resource #2, may be used to modify the activity), calculators, and scissors to each group.
- Tell the students the playground is a 24' by 36' rectangle.
- Generate a discussion, using models and examples, to show the importance of using scale when making a model. Some suggestions follow:

- Equipped with yardsticks, have a few students attempt to show the dimensions of the playground within the classroom.
- From that activity, students should conclude that a model must be used to represent the actual size of the playground.

- Model two possible proportions that could be used.

Examples: $1" = 1'$ so the model would be 24 inches by 36 inches
 $1" = 2'$ so the model would be 12 inches by 18 inches

- In groups, ask the students to find as many of the other possibilities as they can.
 - $1" = 3'$ so the dimensions would be 8 inches by 12 inches
 - $1" = 4'$ so the dimensions would be 6 inches by 9 inches
 - $1" = 6'$ so the dimensions would be 4 inches by 6 inches
 - $1" = 12'$ so the dimensions would be 2 inches by 3 inches
- Have each group draw and cut out the possibilities on large paper.
- Select one student from each group to bring up one paper cut out, so that all six possibilities are represented on the board.
- Lead a discussion to decide the most appropriate model size, keeping in mind the size of the materials.

The scale $1" = 2'$ is the most appropriate.

- At this time, each group should use a ruler to measure and draw the dimensions of the playground area using the scale $1" = 2'$ on their large plain paper or grid paper.

Day Two

- Review polygons, shapes, solid figures, and angles. Display some models of each.
- Review the criteria and rubric on Student Resource #1.
- Distribute paper, rulers, compasses, and protractors to each group.
- Instruct each group to design the equipment in order to meet the criteria. They should use plain paper to complete this part of the activity. Ask the group to draw its equipment on plain paper and paste it onto the rough draft playground outline.
- Remind the students to bring in any additional materials to use for their model on the following day.

Day Three

- Place the building materials in a central location.
- Distribute each group's paper model and foam board.
- Keeping scale in mind, each group begins to construct its playground on foam board (Teacher may wish to cut the foam board in advance).

Day Four

- Groups continue to construct and complete their three-dimensional models.
- Groups that complete their playgrounds early, may attempt the Extensions. (See Extensions/Follow-Up)

Day Five

- Have each student write a persuasive letter to the P.T.A. convincing it that his or her model should be selected.
- Distribute Student Resource #3.
- Using Student Resource #4, each group judges and scores its classmates' models.

Evaluation:

Students can be evaluated based upon the following:

- group participation and performance. Check daily for individual participation, accountability, and on-task behaviors.
- understanding of geometric concepts.
- adherence to criteria.
- recognition of prescribed geometric figures when judging classmates' models.
- attention to form, audience, topic, purpose in their persuasive letters.

Extensions/Follow Up:

- Students may use *Logo Writer*™ or *Super Print*™ to design their playground.
- Students may create a sign to display at the entrance to the playground.
- Students may plan a grand opening.

Authors:

Maureen O. Ames
Carroll Manor Elementary School
Baltimore County

Nancy J. Wagner
Park Elementary School
Anne Arundel County

Rachelle L. Klein
Lewisdale Elementary School
Prince George's County

Brenda S. Shlian
Hampton Elementary School
Baltimore County

GEO-WORLD CONTEST

THE P.T.A. has announced a school-wide contest for the design of a new Geo-World Playground. Students will work in groups to develop and construct a model for the new playground. The Geo-World models must contain the following:

- four pieces of equipment
- proper dimensions of rectangular playground enclosed in a fenced area

Geometric Criteria:

- two right angles
- one acute angle
- two triangles
- one hexagon or pentagon
- one solid figure (cube, rectangular prism, sphere, cylinder, cone)
- one circle
- one quadrilateral

GEO-WORLD RUBRIC

Exceptional

- Playground has proper dimensions
- All four pieces of equipment
- All seven geometric criteria present
- Fence

High

- Playground has proper dimensions
- All four pieces of equipment
- At least five geometric criteria present

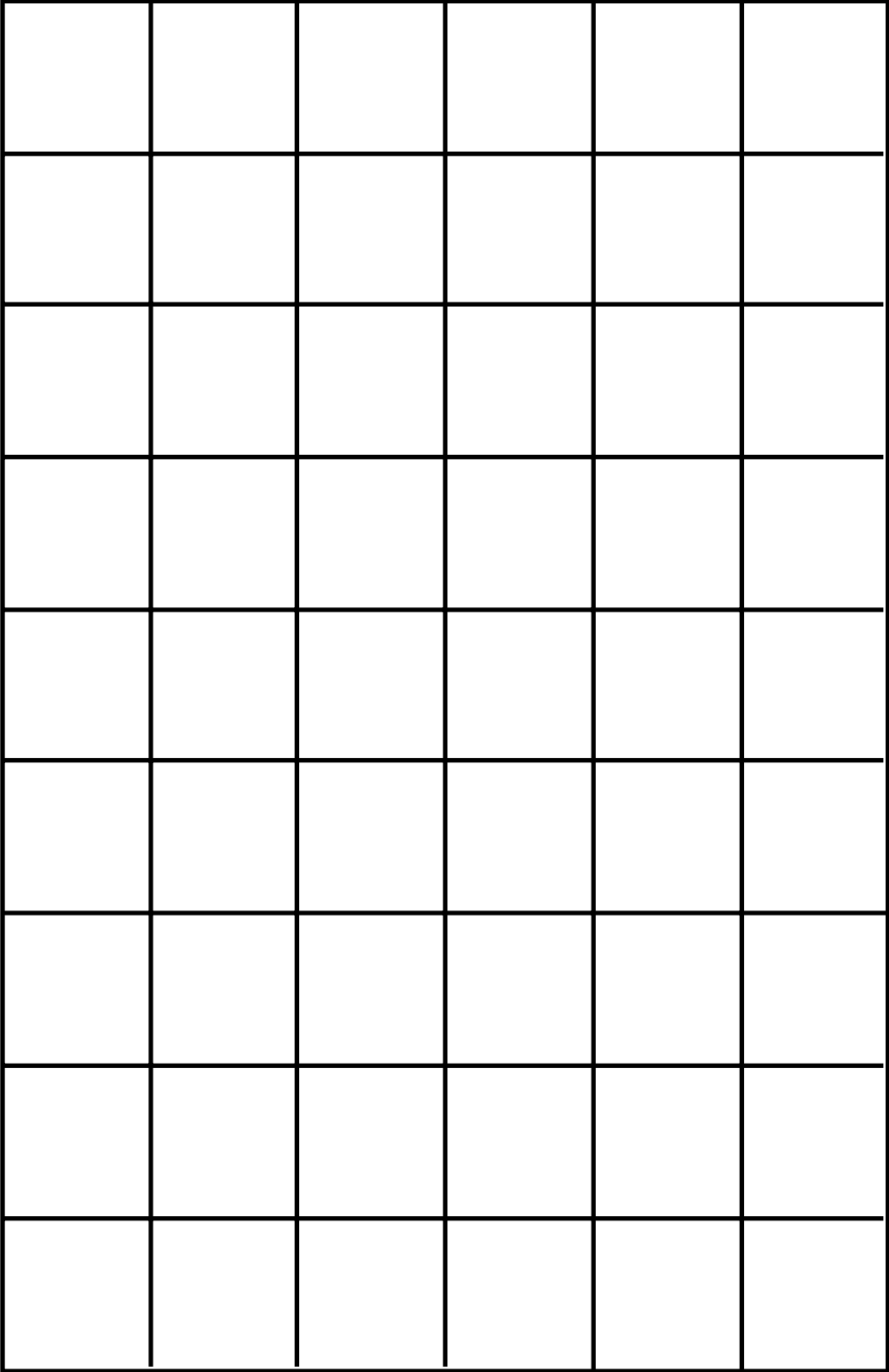
Medium

- Playground is a rectangle
- At least three pieces of equipment
- At least three geometric criteria present

Low

- Playground is a rectangle
- At least two pieces of equipment
- At least one geometric criteria present

Grid Paper



Geo-World Writing Prompt

Your team really wants to win the design contest. You decide to write a letter to the P.T.A. board persuading them to choose your model.

As you are writing your letter, think about safety, appearance, and age appropriateness for the equipment.

Check your letter for form, audience, topic, and purpose.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Geo-World Evaluation

Group: _____

Criteria:

- ___ Four pieces of equipment
- ___ Proper dimensions of rectangular playground enclosed in a fenced area

Geometric Criteria:

- ___ Two right angles
- ___ One acute angle
- ___ Two triangles
- ___ One hexagon or pentagon
- ___ One solid figure (cube, rectangular prism, sphere, cylinder, cone)
- ___ One circle
- ___ One quadrilateral

Rubric: (Circle the level)

Exceptional

- Playground has proper dimensions
- All four pieces of equipment
- All seven geometric criteria present
- Fence

High

- Playground has proper dimensions
- All four pieces of equipment
- At least five geometric criteria present

Medium

- Playground is a rectangle
- At least three pieces of equipment
- At least three geometric criteria present

Low

- Playground is a rectangle
- At least two pieces of equipment
- At least one geometric criteria present

Evaluators: _____

Geo-World Evaluation

Group: _____

Criteria:

- ___ Four pieces of equipment
- ___ Proper dimensions of rectangular playground enclosed in a fenced area

Geometric Criteria:

- ___ Two right angles
- ___ One acute angle
- ___ Two triangles
- ___ One hexagon or pentagon
- ___ One solid figure (cube, rectangle prism, sphere, cylinder, cone)
- ___ One circle
- ___ One quadrilateral

Rubric: (Circle the level)

Exceptional

- Playground has proper dimensions
- All four pieces of equipment
- All seven geometric criteria present
- Fence

High

- Playground has proper dimensions
- All four pieces of equipment
- At least five geometric criteria present

Medium

- Playground is a rectangle
- At least three pieces of equipment
- At least three geometric criteria present

Low

- Playground is a rectangle
- At least two pieces of equipment
- At least one geometric criteria present

Evaluators: _____